INTERSTATE COMMERCE COMMISSION

WASHINGTON

REPORT NO 3547

BOSTON AND ALBANY RAILROAD COMPANY

IN RE ACCIDENT

AT PALMER, MASS., ON

NOVEMBER 23, 1953

SUMMARY

Date:	November 23, 1953	
Railroad:	Boston and Albany	
Location:	Palmer, Mass.	
Kind of accident:	Rear-end collision	
Trains involved:	Passenger	Passenger
Train numbers:	602	78
Engine number:		Diesel-electric units 4086 and 4085
Consists:	1 Diesel-powered car	10 cars
Speeds:	Standing	30 m. p. h.
Operation:	Signal indications	
Tracks:	Double, tangent, 0 33 percent ascending grade eastward	
Weather:	Raining	
Time:	10 50 a. m.	
Casualties:	1 killed, 17 injured	
Cause.	False proceed signal indication, due to failure properly to shunt a track circuit	

INTERSTATE COMMERCE COMMISSION

REPORT NO. 3547

IN THE MATTER OF MAKING ACCIDENT INVESTIGATION REPORTS UNDER THE ACCIDENT REPORTS ACT OF MAY 6, 1910.

BOSTON AND ALBANY RAILROAD COMPANY

January 18, 1954

Accident at Palmer, Mass., on November 23, 1953, caused by a false proceed signal indication, due to failure properly to shunt a track circuit.

REPORT OF THE COMMISSION[1]

CLARKE, Commissioner:

On November 23, 1953, there was a rear-end collision between two passenger trains on the Boston and Albany Railroad at Palmer, Mass., which resulted in the death of 1 passenger, and the injury of 11 passengers, 4 postal transfer clerks, and 2 train-service employees. This accident was investigated in conjunction with representatives of the Massachusetts Department of Public Utilities.

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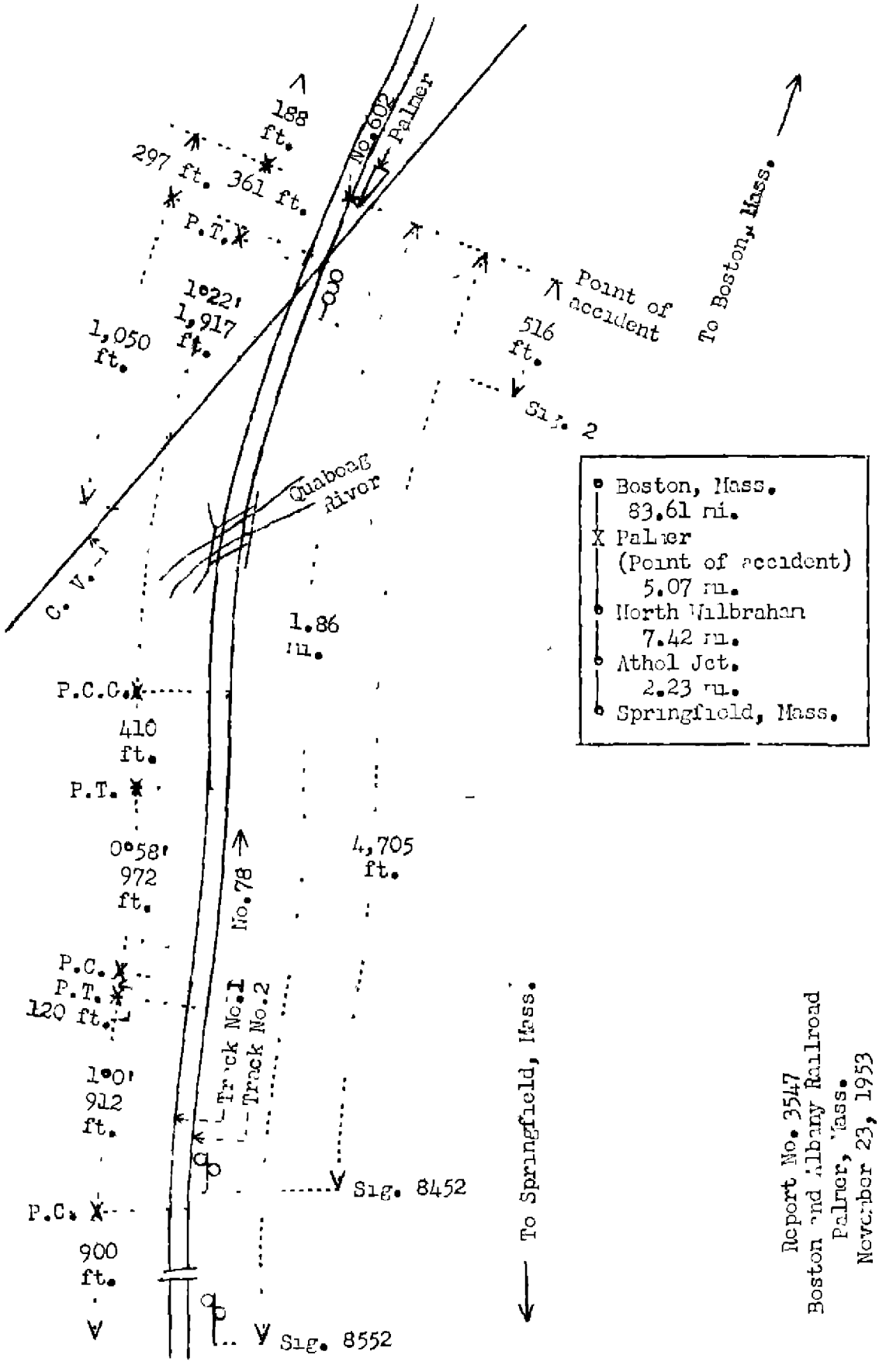
[1] Under authority of section 17 (2) of the Interstate Commerce Act the above-entitled proceeding was referred by the Commission to Commissioner Clarke for consideration and disposition.



Report No. 3547
Boston and Albany Railroad
Palmer, Mass.
November 23, 1953

Location of Accident and Method of Operation

This accident occurred on that part of the railroad extending between Springfield and Boston, Mass., 98.33 miles. In the vicinity of the point of accident this is a double-track line, over which trains moving with the current of traffic are operated by signal indications supplemented by an intermittent inductive automatic train-stop system. The main tracks from north to south are designated as No. 1, westward, and No. 2, eastward. At Palmer, 14.72 miles east of Springfield, the railroad is crossed at grade by a single-track line of the Central Vermont Railway. The station is located immediately east of the crossing, in the southeast angle of the intersection. The accident occurred on track No. 2 at a point 297 feet east of the center-line of the crossing. From the west there are, in succession, a tangent 900 feet in length, a 1° curve to the right 912 feet, a tangent 120 feet, a 0°58' curve to the left 972 feet, a tangent 410 feet, a compound curve to the right, having a maximum curvature of 1°22', 1,917 feet, and a tangent 361 feet to the point of accident and 189 feet eastward. The grade for east-bound trains on track No. 2 varies between 0.68 percent and 0.49 percent descending throughout a distance of 1.27 miles and then is, successively, 0.16 percent descending a distance of 335 feet, practically level 665 feet, and 0.33 percent ascending 350 feet to the point of accident and 250 feet beyond.

Movements over the crossing at Palmer are governed by interlocking signals. Automatic signals 8552 and 8452 and semi-automatic signal 2, governing east-bound movements on track No. 2, are located, respectively, 1.86 miles, 4,705 feet, and 516 feet west of the point of accident. Signals 8552 and 8452 are of the 2-unit searchlight type, and each displays four aspects. Signal 2 is of the 3-unit searchlight type and displays five aspects. These signals are approach lighted. The aspects applicable to this investigation and the corresponding indications are as follows:

Signal	Aspect	Indication
8552	Green-over-green, staggered	PROCEED.

8552	Yellow-over-yellow, staggered	PROCEED PREPARING TO STOP AT SECOND SIGNAL. TRAIN EXCEEDING LIMITED SPEED MUST AT ONCE REDUCE TO THAT SPEED. REDUCTION TO LIMITED SPEED MUST COMMENCE BEFORE PASSING SIGNAL AND BE COMPLETED BEFORE ACCEPTING A MORE FAVORABLE INDICATION.
8452	Green-over-green, staggered	PROCEED.
	Yellow-over-red, staggered	PROCEED PREPARING TO STOP AT NEXT SIGNAL. TRAIN EXCEEDING MEDIUM SPEED MUST AT ONCE REDUCE TO THAT SPEED. REDUCTION TO MEDIUM SPEED MUST COMMENCE BEFORE PASSING SIGNAL AND BE COMPLETED BEFORE ACCEPTING A MORE FAVORABLE INDICATION.
2	Green-over-green-over-red, vertical	PROCEED.
	Red-over-red-over-yellow, vertical	PROCEED AT RESTRICTED SPEED.

The controlling circuits are so arranged that when the blocks of signals 8552 and 8452 are clear, the block of signal 2 is occupied, and a signal has not been displayed for a movement on the Central Vermont line, signal 8552 indicates PROCEED PREPARING TO STOP AT SECOND SIGNAL, signal 8452 indicates PROCEED PREPARING TO STOP AT NEXT SIGNAL, and signal 2 indicates PROCEED AT RESTRICTED SPEED.

The interlocking at the crossing normally is lined for movements on the Boston and Albany line. Push-button controls are provided to actuate the signals for movements over the crossing on the Central Vermont line.

Visual and audible indicators are provided in Interlocking Station 40, located at Springfield, which indicate track occupancy of a 175-foot section of track No. 2 at a point immediately east of the crossing at Palmer.

This carrier's operating rules read in part as follows

SIGNAL DEFINITIONS.

Limited Speed.--A speed not exceeding forty-five miles per hour.

Medium Speed.--A speed not exceeding thirty miles per hour.

Slow Speed.--A speed not exceeding fifteen miles per hour.

Restricted Speed.--A speed not exceeding that which will enable a train to stop short of train ahead, obstruction, or switch not properly lined, look out for broken rail, and not exceeding slow speed.

34. The engineman and fireman must, and when practicable the trainmen will, communicate to each other the indication of all signals affecting the movement of their train.

35. The following signals will be used by flagmen

Day signals- A red flag, * * *
Torpedoes,
Fusees.

99. When a train stops under circumstances in which it may be overtaken by another train, the flagman must go back immediately with flagman's signals a sufficient distance to insure full protection, placing two torpedoes, and when necessary, in addition, displaying lighted fusees. * * *

* * *

When a train is moving under circumstances in which it may be overtaken by another train, the flagman must take such action as may be necessary to insure full protection. By night, or by day when the view is obscured fusees must be thrown off at proper intervals.

* * *

Note.--When trains are operating under Automatic Block System Rules, the requirements of Rule 99, in so far as protecting against following trains is concerned, will have been complied with when full protection is afforded against trains moving at Restricted Speed.

Special instructions to engineers and conductors operating Diesel-powered passenger cars of the type involved in this accident were issued February 7, 1951, reading as follows:

When making stops at intermediate stations and sand is used in making the stop, after the stop is made the car will be moved forward two (2) or three (3) feet.

The maximum authorized speed for passenger trains is 65 miles per hour, but it is restricted to 50 miles per hour at the crossing at Palmer.

Description of Accident

No. 602, an east-bound first-class passenger train, consisted of Diesel-powered passenger car M-463. This train departed from Springfield, the last open office, at 10 04 a. m., 4 minutes late. Because of engine trouble which developed en route it was stopped at Athol Jct., 2.23 miles east of Springfield. About 20 minutes later it proceeded eastward and stopped about 10 45 a. m. on track No. 2 at the station at Palmer, with the rear end 516 feet east of signal 2 and 297 feet east of the crossing. About 5 minutes later the rear end was struck by No. 78.

No. 78, an east-bound first-class passenger train, consisted of Diesel-electric units 4086 and 4085, coupled in multiple-unit control, one express-refrigerator car, one mail car, one passenger-baggage car, two coaches, one dining car, and four sleeping cars, in the order named. The first car was of steel-underframe construction, the

second, third, and sixth cars were of conventional all-steel construction, and the other cars were of lightweight steel construction. This train departed from Springfield at 10:10 a. m., 5 minutes late, and stopped behind No. 602 at Athol Jct. in compliance with signal indications and flagging signals given by the conductor of the preceding train. After No. 602 moved eastward and the indication of the interlocking signal at Athol Jct. changed from Stop to Approach, No. 78 proceeded. It stopped at the location of a lighted red fusee approximately 5 miles west of the point of accident, and then proceeded. This train passed signals 8552 and 8452, each of which displayed a green-over-green aspect, passed signal 2, which displayed a green-over-green-over-red aspect, and while moving at a speed of about 30 miles per hour it collided with the rear end of No. 602.

No. 602 was moved eastward a distance of 254 feet by the force of the impact. The rear vestibule was crushed inward and the car was badly damaged. No equipment of either train was derailed. No. 78 stopped with the front end of the locomotive 239 feet east of the point of collision. The front end of the locomotive was somewhat damaged.

The engineer and the conductor of No. 602 were injured.

It was raining at the time of the accident, which occurred about 10.50 a. m.

Diesel-powered passenger car M-463 is of stainless steel construction. It is 85 feet long between the pulling faces of the couplers and is mounted on two 4-wheel trucks. It weighs 113,000 pounds in working order and 128,000 pounds when loaded. Power is supplied by two 275-horsepower Diesel engines mounted under the car floor. Each engine drives the inboard axle of one truck and is placed adjacent to it. A torque converter transmission is provided. An operator's station is located at the right-hand side of the vestibule at each end of the car. The car is equipped with disc brakes and HSC type air-brake equipment with D22 control valve. A safety-control feature actuated by a foot pedal is provided. The push-button switches by which the engines are started and stopped are located in the engine housings and can be operated only from the ground. Provision is made for automatic protection of the engines against overspeed, overheat, or loss of lubrication.

The car is equipped with a push button for manual control of sanding devices. Sand delivery hose and the related traps and delivery nozzles are provided. These are so located that, when the car is moving in either direction and the sanding devices are actuated, sand is deposited on the rails in front of the front wheels of each truck. The rate of flow of sand is regulated by pre-adjustment of air-pressure nozzles located in the traps.

The wheelbase of each truck is 8 feet 6 inches long. The trucks are equipped with 33-inch wheels having standard tapered wheel treads. Wheel-tread conditioning shoes are provided. These consist of 2-1/2-inch by 6-inch cast-iron shoes of proper contour applied in such manner that they bear against the tops of the wheel treads. They are held against the wheel treads by steel torsion bars. A screw adjustment permits regulation of the tension on these bars to vary the pressure of individual shoes from zero to 50 pounds. The trucks are bonded to the car body by bond wires.

A brake disc is bolted to the inner face of each wheel. An anti-wheel-slide device is provided. This consists of inertia devices applied to a journal box of each axle and connected in such manner that an excessive rate of deceleration of any axle closes electrical contacts which actuate an electric solenoid valve in the control box to release air from the brake cylinder and, under control of a time relay, reopen the circuit to reapply air to the brake cylinder after an interval of about 1 second. Automatic sanding of the rails during an emergency application of the brakes is provided. During service application of the brakes, an excessive rate of deceleration of any axle will actuate the sanding apparatus for a 6-second cycle and cause sand to be deposited on the rails in front of the front wheels of the trucks.

Discussion

The crew of No. 602 consisted of an engineer and a conductor. When this train departed from Springfield the engineer was operating the car from the control compartment in the front vestibule. The conductor was in the passenger compartment. Engine trouble developed soon after the train departed from Springfield, and the train stopped at Athol Jct. because both Diesel engines had ceased to function. Immediately after the car stopped, the conductor proceeded to the rear to provide flag protection. The

engineer alighted from the control compartment to start the engines. Several minutes later No. 78 arrived and stopped behind the car. There was a delay of approximately 20 minutes before the Diesel engines were restored to operation and the car proceeded eastward. The engineer said that soon after the train passed North Wilbraham, 5.07 miles west of Palmer, one Diesel engine again ceased operation. The car then proceeded at a speed of about 40 miles per hour. Soon afterward the engineer shut off the power on a descending grade, and the second Diesel engine ceased to function.

As this train was approaching Palmer the engineer was maintaining a lookout ahead from the control compartment. The conductor was in the passenger compartment of the car. The brakes of this train had been tested and had functioned properly when used en route. All signals passed en route were lighted, and the engineer said that he did not observe any flickering of the signal lights as the car approached. The speed was reduced as the car approached the west end of a bridge located 1,050 feet west of the crossing, where several bridge and building department employees were working. The engineer said that he used the manual sanding control at this point. Because both Diesel engines had ceased to function, he was aware that it would not be possible to make two stops at the station. For this reason he reduced the speed to approximately 6 or 8 miles per hour and approached the station at low speed. He pressed the push button of the sander control lightly several times immediately after the car had passed over the crossing. He said that the anti-wheel-slide device was not actuated while the stop was being made and that the car was stopped at the desired point by a brake application. He immediately alighted from the control compartment to inspect the engines, and the conductor entered the station to inform the train dispatcher that the car was disabled. Soon afterward the conductor returned and informed the engineer that their passengers were to be transferred to No. 78 at Palmer. The engineer then made a second attempt to start the engines. Necessary adjustments were made, and after the engines were started he heard the pneumatic horn of a locomotive and observed No. 78 approaching. He immediately boarded the car and attempted to move it eastward, but the collision occurred before the car could be started. The conductor was so seriously injured in the accident that he could not be questioned during the investigation.

As No. 78 was approaching the point where the accident occurred the enginemen were maintaining a lookout ahead from the control compartment at the front of the locomotive. The members of the train crew were in various locations in the cars of the train. The fireman, a qualified engineer, was operating the locomotive under supervision of the engineer. The headlight was lighted. The brakes of this train had been tested and had functioned properly when used en route. The enginemen said that the interlocking signal at Athol Jct. indicated Approach when their train departed from that station, and that each signal east of that point indicated Proceed as their locomotive approached. The brakes were applied and the train was stopped in the vicinity of North Wilbraham at a point where a lighted red fusee was displayed. The train then proceeded. The fireman said that he observed a marker light on the rear end of the preceding train when the locomotive was closely approaching the west end of the bridge west of the crossing at Palmer. He immediately moved the brake valve to emergency position, sounded warning blasts on the pneumatic horn, and manually operated the sanding valve. The engineer said that he observed the rear end of the preceding train and called a warning at the same time that the fireman made an emergency application of the brakes. According to the tape of the speed-recording device, the speed of the train was 51 miles per hour when the brakes were applied and was reduced to about 30 miles per hour at the point of collision. The tape indicates that the forestalling device of the automatic train-stop apparatus was not operated at the signals in approach to the point of accident and that the brakes were applied in emergency when the locomotive was about 750 feet west of the point of accident.

The signals involved were inspected after the accident occurred, and no defective condition was found. It was observed that while No. 78 was stopped at the point where the accident occurred, signal 2 was lighted and displayed the proper aspect. In tests which were made between 8:30 p. m. and 10:45 p. m. on the day of the accident, the signal system functioned as intended.

The brakes of the equipment of No. 78 were tested after the accident occurred, and they functioned properly. The automatic train-stop apparatus of the locomotive of this train was tested at Worcester, Mass., 1 hour 40 minutes after the accident occurred, and it functioned as intended. It was again inspected and tested at Beacon Park, Mass., on November 24, 1953. No defective condition was found.

The equipment of No. 602 was inspected at the scene of the accident by a member of the signal force soon after the collision occurred. It was found that although all wheel-tread conditioning shoes were in place, the wheels of the car were so heavily coated with sand that the metal of the wheel treads was visible only at scattered points around the periphery of the wheels. There was sand on the rails throughout a considerable distance on either side of the point of accident. The brakes of the car had been applied in emergency when the brake pipe at the rear of the unit was ruptured in the collision, and the automatic sanding device of the locomotive of the following train had also been actuated by an emergency brake application made west of the point of collision. Car M-463 was later removed to the shops at West Albany, N. Y., and the sanding devices were tested at that point on November 30, 1953. In a test of 3 minutes duration the eight sanders discharged a total of 74 pounds 3 ounces of sand. The average discharge per trap was 3 pounds 1.4 ounces of sand per minute. The traps are normally adjusted to discharge 1 pound 12 ounces of sand per minute. The wheel-tread conditioning shoes were inspected, and it was found that the tension adjustment of the shoes against the wheels of the car was 25 pounds on each of three wheels, 24 pounds on each of three wheels, and 23 pounds and 17 pounds, respectively, on each of the other wheels. The prescribed tension adjustment for each of the shoes is 20 pounds, with tolerance of variations up to 5 pounds more or less.

In further tests of the signal system, seven test runs were made at Palmer on November 24, 1953. Diesel-powered car M-456, of the same type as car M-463, was used in these tests. On each run the car was operated eastward from a point a short distance west of signal 2 and stopped at the approximate point at which No. 602 stopped on the day of the accident. In order to provide conditions similar to those which existed at the time the accident occurred, water was poured on the rails before the tests were begun and the rails were washed after each run, except the sixth. In each of the first three tests the rails were sanded lightly. In the first test the circuits shunted properly. In the second test, the shunt was lost as the car was slowing down, but was restored when the car stopped. In the third test, the shunt was lost when the car stopped. No sand was used in the fourth test, and the circuits shunted properly. Sand was used in the fifth and

sixth tests, and in each of these tests the circuits shunted properly. Sand was not used during the seventh test, but the track was not washed and the car was run over the sand which had been deposited on the rails during the sixth test. The shunt was lost as the car was slowing down, was then restored momentarily, and was lost when the car stopped. In each instance in which the shunt was lost when the car stopped, it was restored when the car was moved forward a distance of about 5 feet. The car was operated at various speeds up to a maximum of 25 miles per hour during these tests.

Diesel-powered cars of the type involved in this accident were first put in service in this territory May 1, 1950. Because of frequent failures of the track circuits to be shunted when occupied by this type of equipment, manual block protection against following movements was established for these cars May 2, and continued until July 12, 1950. During the intervening period track circuits having higher shunting sensitivity were installed. Copper wheel-tread conditioning shoes were applied on the outer wheels of each truck of one car on June 14, 1950, and 5 days later similar shoes were applied on the other wheels of the car. These were designed, in the absence of brake-shoe action on outer surfaces of the wheels, to clean the wheel treads and to keep the contact surfaces of the wheels free of dirt film or any extraneous material which might impair their conductivity. The operation with these shoes, as determined by recording meters and observations of the signals, was found to be satisfactory, and all cars were similarly equipped. On June 30, 1950, instructions were issued to provide electric bond wires between the wheel-tread conditioning shoes and truck frames and between truck frames and body bolsters of these cars. Later the copper wheel-tread conditioning shoes were replaced by cast-iron shoes of similar design. On August 29, 1952, the signal engineer concurred in a recommendation that the bond wires between the wheels-tread conditioning shoes and the truck frames be removed from this type of equipment.

Two instances in which cars of this type failed to shunt track circuits occurred in November, 1950, and three similar failures occurred in January, 1951. On February 7, 1951, special instructions were issued to engineers and conductors operating this type of equipment which required that when sand was used in making a stop the car was to be moved forward immediately a distance of several feet so that the wheels would not stand at a point where

the rails had been sanded. Previous to the instant case, other failures of track circuits to be shunted properly when occupied by Diesel-powered passenger cars were reported to have occurred on April 10, 1951, October 26, 1953, and October 28, 1953. In each of these cases the failure of the track circuits to be shunted was ascribed to the car having been stopped at a point where there was sand on the rails. In addition, numerous cases of intermittent loss of shunt have occurred on tracks where a considerable period of time intervened between train movements during periods of light traffic.

On the day of the accident the manual sander control of Diesel-powered car M-463 was used several times by the engineer as No. 602 was closely approaching the station at Palmer. Because the engineer intended to sand the rails lightly and to avoid the use of sand at the point at which the car was to be stopped, he did not fully depress the button of the sander control but struck it lightly several times at the points at which he desired to sand the rails. The district supervisor of air brakes said that it would be necessary to depress the button of the sander control fully to actuate the sanding devices and that when the sanders were operated they would continue to discharge sand for a period of about 3 seconds after the button was released. He said that momentary depression of the button by the engineer striking it would actuate only the clean-out feature in the traps and that no appreciable amount of sand would be deposited on the rails from such action. It could not be determined to what extent, if any, the rails had been sanded by car M-463. The engineer said that when he was attempting to start the engines at Palmer he noticed that the rails under the car appeared to be covered with mud or silt. He thought that this was dirt which had splashed up from around the ties. The car actuated the indicators at Interlocking Station 40 as it passed over the track section immediately east of the crossing. However, these indicators do not indicate track occupancy at the point at which the train stopped, and the fact that the signals to the rear of the train indicated Proceed after the train stopped indicates that the track circuit was not properly shunted or that the shunt was lost when the train stopped at the station.

Flag protection was not provided for No. 602 at Palmer. However, under the rules only flag protection against a following train being operated at restricted speed was required, and the fireman of No. 78, who was operating the locomotive, said that flag protection furnished against following trains moving at restricted speed would not have been sufficient under the existing conditions for the reason that No. 78 did not receive restrictive signal indications.

After this accident occurred the carrier re-established the requirement for positive block protection against following movements for single-unit Diesel-powered passenger cars of the type here involved. This protection should be continued until such time as means have been developed to insure reliable operation of the automatic block-signal system by these cars.

Cause

This accident was caused by a false proceed signal indication, due to failure properly to shunt a track circuit.

Dated at Washington, D. C., this eighteenth day of January, 1954.

By the Commission, Commissioner Clarke.

(SEAL)

GEORGE W. LAIRD,

Secretary.